## WHAT IS CLAIMED IS:

1. A process for synthesizing a substantially single diastereomeric form of an inositolphospholipid, wherein said inositolphospholipid has the target phosphatidyl-myo-inositol structure:

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1D-1-(1-fattyacyl<sup>1</sup>-2-fattyacyl<sup>2</sup>-sn-glycero-3-phospho)-myo-inositol;
1D-1-(3-fattyacyl<sup>1</sup>-2-fattyacyl<sup>2</sup>-sn-glycero-1-phospho)-myo-inositol;
1L-1-(1-fattyacyl<sup>1</sup>-2-fattyacyl<sup>2</sup>-sn-glycero-3-phospho)-myo-inositol;
1L-1-(3-fattyacyl<sup>1</sup>-2-fattyacyl<sup>2</sup>-sn-glycero-1-phospho)-myo-inositol;
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wherein fattyacyl<sup>1</sup> and fattyacyl<sup>2</sup> are identical or non-identical;

said process comprising the steps of:

- (a) obtaining a lipid synthon, wherein said lipid synthon is a substantially pure enantiomeric form of 1-fattyacyl<sup>1</sup>-2-fattyacyl<sup>2</sup>-sn-glycero-3-phosphoric acid or 3-fattyacyl<sup>1</sup>-2-fattyacyl<sup>2</sup>-sn-glycero-1-phosphoric acid;
- (b) obtaining a *myo*-inositol synthon, wherein said *myo*-inositol synthon is a substantially pure enantiomeric form of a selectively partially *O*-protected 1D-1-*myo*-inositol, wherein at least the 1-equatorial hydroxyl is free, the 3-hydroxyl and at least three other hydroxyls carry temporary *O*-protecting groups;
- reacting said lipid synthon with said *myo*-inositol synthon in the presence of a phosphoric group activating reagent system, thereby linking the two synthons by a phosphodiester bond and creating an *O*-protected derivative of the target phosphatidyl-*myo*-inositol as an intermediate; and
- (d) subjecting said *O*-protected intermediate to a deprotection process to completely remove the protecting groups, thereby forming the target phosphatidyl-*myo*-inositol diastereomer.
- 2. The process of claim 1, further comprising subjecting said target phosphatidyl-*myo*-inositol diastereomer to purification to eliminate non-phosphatidyl-*myo*-inositol contaminants.
- 3. The process of claim 1, wherein said inositolphospholipid has the target phosphatidyl-myo-inositol structure 1D-1-(1-fattyacyl<sup>1</sup>-2-fattyacyl<sup>2</sup>-sn-glycero-3-phospho)-myo-inositol or 1D-1-(3-fattyacyl<sup>1</sup>-2-fattyacyl<sup>2</sup>-sn-glycero-1-phospho)-myo-inositol.

- 4. The process of claim 1, wherein said inositolphospholipid has the target phosphatidyl-myo-inositol structure 1L-1-(1-fattyacyl<sup>1</sup>-2-fattyacyl<sup>2</sup>-sn-glycero-3-phospho)-myo-inositol or 1L-1-(3-fattyacyl<sup>1</sup>-2-fattyacyl<sup>2</sup>-sn-glycero-1-phospho)-myo-inositol.
- 5. The process of claim 1, where said target phosphatidyl-*myo*-inositol comprises a saturated chain lipid.
- 6. The process of claim 1, where said target phosphatidyl-*myo*-inositol comprises a lipid chain comprising a functional group with at least one double or triple bond.
- 7. A substantially single diastereomeric form of an inositolphospholipid prepared by the process of claim 1.
- 8. A substantially single diastereomeric form of an inositolphospholipid, wherein said inositolphospholipid has the phosphatidyl-myo-inositol structure:

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1D-1-(1-fattyacyl<sup>1</sup>-2-fattyacyl<sup>2</sup>-sn-glycero-3-phospho)-myo-inositol;
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1D-1-(3-fattyacyl<sup>1</sup>-2-fattyacyl<sup>2</sup>-sn-glycero-1-phospho)-myo-inositol;

1L-1-(1-fattyacyl<sup>1</sup>-2-fattyacyl<sup>2</sup>-sn-glycero-3-phospho)-myo-inositol;

1L-1-(3-fattyacyl<sup>1</sup>-2-fattyacyl<sup>2</sup>-sn-glycero-1-phospho)-myo-inositol;

wherein fattyacyl<sup>1</sup> and fattyacyl<sup>2</sup> are identical or non-identical; and

said inositolphospholipid has a molar rotation substantially equal to the bench-mark value established for the specific diastereomer structure.